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JUN 29 2007

HEWLETT-PACKARD COMPANY
Intellectual Property Administration
P.O. Box 272400
Fort Collins, Colorado 80527-2400

PATENT APPLICATION

ATTORNEY DOCKET NO. 200308743-1

Inventor(s): Nickel et al.

Confirmation No.: 9147

Application No.: 10/733,089

Examiner: Dickey, Thomas

Filing Date: December 11, 2003

Group Art Unit: 2826

USING SENSE LINES TO THERMALLY CONTROL THE STATE OF AN MRAM
Title:

Mail Stop Amendment
Commissioner For Patents
PO Box 1450
Alexandria, VA 22313-1450

TRANSMITTAL LETTER FOR RESPONSE/AMENDMENT

Transmitted herewith is/are the following in the above-identified application:

- ☒ Response/Amendment
☐ New fee as calculated below
☒ No additional fee
☐ Other

- ☐ Petition to extend time to respond
☐ Supplemental Declaration

Fee\$

| CLAIMS AS AMENDED BY OTHER THAN A SMALL ENTITY | | | | | | |
|---|---|---|--|--|-------------|---------------------------|
| (1) FOR | (2) CLAIMS REMAINING AFTER AMENDMENT | (3) NUMBER EXTRA | (4) HIGHEST NUMBER PREVIOUSLY PAID FOR | (5) PRESENT EXTRA | (6) RATE | (7) ADDITIONAL FEES |
| TOTAL CLAIMS | 11 | MINUS | 29 | = 0 | X \$50 | \$ 0 |
| INDEP. CLAIMS | 1 | MINUS | 3 | = 0 | X \$200 | \$ 0 |
| <input type="checkbox"/> FIRST PRESENTATION OF A MULTIPLE DEPENDENT CLAIM | | | | | + \$360 | \$ 0 |
| EXTENSION FEE | <input type="checkbox"/> 1st Month \$120 | <input type="checkbox"/> 2nd Month \$450 | <input type="checkbox"/> 3rd Month \$1020 | <input type="checkbox"/> 4th Month \$1590 | | \$ 0 |
| OTHER FEES | | | | | | \$ |
| TOTAL ADDITIONAL FEE FOR THIS AMENDMENT | | | | | | \$ 0 |

Charge \$ 0 to Deposit Account 08-2025. At any time during the pendency of this application, please charge any fees required or credit any over payment to Deposit Account 08-2025 pursuant to 37 CFR 1.25. Additionally charge any fees to Deposit Account 08-2025 under 37 CFR 1.16 through 1.21 inclusive, and any other sections in Title 37 of the Code of Federal Regulations that may regulate fees. A duplicate copy of this sheet is enclosed.

I hereby certify that this paper is being
transmitted to the Patent and Trademark Office
facsimile number (571) 273-8300.

Date of facsimile: June 29, 2007

Typed Name: Wendell J. Jones

Signature: 

Respectfully submitted,

Nickel et al.

By 

Wendell J. Jones

Attorney/Agent for Applicant(s)

Reg No.: 45,961

Date: June 29, 2007

Telephone: (408) 938-0980

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JUN 29 2007

Application No. 10/733,089
Responsive to the Office Action of May 9, 2007

page 1

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Nickel et al.

Attorney Docket No.:
200308743-1

Application No.: 10/733,089

Examiner: Dickey, Thomas
I.

Filed: December 11, 2003

Title: USING SENSE LINES TO THERMALLY CONTROL
THE STATE OF AN MRAM

Art Unit: 2826

Confirmation No.: 9147

Amendment and Response To Office Action

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the Office Action mailed May 9, 2007, please consider the following:

Amendments to the Claims begin on **Page 2** of this response.

Remarks begin on **Page 4** of this response.

Application No. 10/733,089
Responsive to the Office Action of May 9, 2007

page 2

The listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) A magnetic random access memory device comprising: a plurality of magnetic memory elements; a sense line coupled to the plurality of magnetic memory elements for sensing a magnetic orientation of at least one of the plurality of magnetic memory elements wherein the sense line includes a first via and a second via; and wherein the sense line is utilized to thermally assist in switching a magnetic orientation of the at least one of the plurality of magnetic memory elements.
2. (Original) The device of claim 1 wherein each of the plurality of magnetic memory elements comprises a spin dependent tunnel junctions.
3. (Original) The device of claim 1 wherein each of the plurality of magnetic memory elements comprises a giant magnetoresistive device.
4. (Original) The device of claim 1 wherein the sense line comprises semiconductor material.
5. (Original) The device of claim 1 wherein each of the plurality of magnetic memory elements further comprises at least one write conductor.
6. (Original) The device of claim 1 wherein each of the plurality of magnetic memory elements includes a free layer and switching a magnetic orientation of at least one of the plurality of magnetic memory elements comprises switching a magnetic orientation of the free layer.
7. (Currently Amended) The device of claim 1 further comprising: a current source coupled to the sense line wherein utilizing the sense line to thermally assist in switching a magnetic orientation of the at least one of the plurality of magnetic memory elements further comprises utilizing the current source to provide a current from the first via to the second via wherein the current heats the at least one of the plurality of magnetic memory

Application No. 10/733,089
Responsive to the Office Action of May 9, 2007

page 3

elements.

8. (Original) The device of claim 4 wherein the semiconductor material comprises at least one of Pt, SiC, Si or C material.

9. (Currently Amended) The device of claim 5 wherein the at least one write conductor comprises two write conductors wherein the two write conductors are utilized to switch the magnetic orientation of the at least one of the plurality of magnetic memory elements.

10. (Currently Amended) The device of claim 5 wherein the at least one write conductor comprises only one write conductor wherein the only one write conductor is utilized to switch the magnetic orientation of the at least one of the plurality of magnetic memory elements.

11. (Withdrawn) The device of claim 6 wherein the sense line is above the free layer.

12. (Withdrawn) The device of claim 6 wherein the sense line is below the free layer.

13. (Original) The device 10 wherein the only one write conductor is positioned orthogonal to the sense line.

14. (Withdrawn) A method of switching a magnetic orientation of at least one of a plurality of magnetic memory elements in a magnetic random access device comprising: coupling a sense line to the at least one of the plurality of magnetic memory elements wherein the sense line includes a first via and a second via; and utilizing the sense line to thermally assist in switching a magnetic orientation of the at least one of the plurality of magnetic memory elements.

15. (Withdrawn) The method of claim 14 wherein each of the plurality of magnetic memory elements comprises a spin dependent tunneling junction.

16. (Withdrawn) The method of claim 14 wherein each of the plurality of magnetic

Application No. 10/733,089
Responsive to the Office Action of May 9, 2007

page 4

memory elements comprises a giant magnetoresistive device.

17. (Withdrawn) The method of claim 14 wherein the sense line comprises a semiconductor material.

18. (Withdrawn) The method of claim 14 wherein each of the plurality of magnetic memory elements includes a free layer and switching a magnetic orientation of the at least one of the plurality of magnetic memory elements comprises switching a magnetic orientation of the free layer.

19. (Withdrawn) The method of claim 14 wherein utilizing the sense line to thermally assist in switching a magnetic orientation of the at least one of the plurality of magnetic memory elements further comprising: coupling a current source to the sense line; and utilizing the sense line to heat the at least one of the plurality of magnetic memory elements.

20. (Withdrawn) The method of claim 14 wherein each of the plurality of magnetic memory elements further comprises at least one write conductor.

21. (Withdrawn) The method of claim 17 wherein the semiconductor material comprises at least one of Pt, SiC, Si or C material.

22. (Withdrawn) The method of claim 18 wherein the sense line is above the free layer.

23. (Withdrawn) The method of claim 18 wherein the sense line is below the free layer.

24. (Withdrawn) The method of claim 19 wherein utilizing the sense line to heat the at least one of the plurality of magnetic memory elements further comprises: utilizing the current source to provide a current from the first via to the second via wherein the current heats the at least one of the plurality of magnetic memory elements.

25. (Withdrawn) The method of claim 20 wherein the at least one write conductor comprises two write conductors wherein the two write conductors are utilized to switch

Application No. 10/733,089
Responsive to the Office Action of May 9, 2007

page 5

the magnetic orientation of the magnetic memory elements.

26. (Withdrawn) A computer system comprising: a processor; an interface module coupled to the processor; and a magnetic random access memory device coupled to the interface module wherein the magnetic random access memory device includes a plurality of magnetic tunnel junctions and a sense line coupled to the plurality of magnetic tunnel junctions wherein the sense line includes a first via and a second via, the sense line being capable of thermally assisting in switching a magnetic orientation of the at least one of the plurality of magnetic tunnel junctions.

27. (Withdrawn) The computer system of claim 26 wherein the magnetic random access memory device further comprises: a current source coupled to the sense line wherein utilizing the sense line to thermally assist in switching a magnetic orientation of the at least one of the plurality of magnetic tunnel junctions further comprises utilizing the current source to provide a current from the first via to the second via wherein the current heats the at least one of the plurality of magnetic tunnel junctions.

28. (Withdrawn) The computer system of claim 27 wherein each of the plurality of magnetic tunnel junctions further comprises at least one write conductor.

29. (Withdrawn) The computer system of claim 28 wherein the at least one write conductor comprises two write conductors wherein the two write conductors are utilized to switch the magnetic orientation of the magnetic tunnel junctions.

**RECEIVED
CENTRAL FAX CENTER****JUN 29 2007**Application No. 10/733,089
Responsive to the Office Action of May 9, 2007

page 6

REMARKS

Applicant thanks the Examiner for his thoughtful review of the present application. This application is under final rejection. Applicant has presented amendments that Applicant believes should render the claims allowable. In the event, however, that the Examiner is not persuaded by Applicant's amendments, Applicant respectfully requests that the Examiner enter the amendments to clarify issues upon appeal. The status of the claims is as follows:

- a. **Claims 1-10 and 13 are Pending** in the present application.
- b. **Claims 10, 11 and 14-29** have been previously withdrawn.
- c. **Claims 1-10 and 13** are rejected.
- d. **Claim 1** has been amended for clarification to recite "wherein the sense line is utilized to thermally assist in switching a magnetic orientation of *the* at least one of the plurality of magnetic memory elements".

i. PRESENT AMENDMENT

Independent **Claim 1** was amended to distinctly point out and particularly claim the subject matter the Applicant regards as his invention. Specifically, the claim has been amended to recite "wherein the sense line is utilized to thermally assist in switching a magnetic orientation of *the* at least one of the plurality of magnetic memory elements". No new matter has been introduced with the amendment of this application.

Application No. 10/733,089
Responsive to the Office Action of May 9, 2007

page 7

ii. **ARGUMENT**

a. **Rejections of Claims 1-10 and 13 under 35 U.S.C. §102(e) (673 Reference)**

We respectfully remind the Examiner that in order to anticipate a claim, US Application 2004/0125673 to Daughton et al. (hereinafter *Daughton*) must teach **every element of the claim** and "*the identical invention must be shown in as complete detail as contained in the ... claim.*" MPEP 2131 citing *Verdegaal Bros. V. Union Oil Co. of California*, 814 F.2d 628, 2 USPQ2d 1051 (Fed. Cir. 1987) and *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 9 USPQ2d 1913 (Fed. Cir. 1989) (emphasis added).

The Applicant respectfully traverses the rejection of Claims 1-10 and 13 because all of the elements of independent Claim 1 are not taught or suggested by *Daughton*, as emphasized by the recited claim elements set forth below.

1. A magnetic random access memory device comprising:
plurality of magnetic memory elements;
a sense line coupled to the plurality of magnetic memory elements for sensing a magnetic orientation of at least one of the plurality of magnetic memory elements wherein the sense line includes a first via and a second via; and
wherein the sense line is utilized to thermally assist in switching a magnetic orientation of the at least one of the plurality of magnetic memory elements.

Applicant respectfully disagrees with the Examiner's assessment. The present invention of claim 1 recites a magnetic random access memory device. Accordingly, a sense line is utilized to thermally assist in the switching of the magnetic orientation of magnetic memory elements within the MRAM device. By utilizing the sense line to thermally assist in the switching of the magnetic orientation of magnetic memory elements within the MRAM device, the write current needed to perform the write operations of the MRAM device is substantially reduced.

Application No. 10/733,089
Responsive to the Office Action of May 9, 2007

page 8

The Examiner states that the *Daughton* reference anticipates the present invention. Applicant respectfully disagrees and asserts that the *Daughton* reference does not disclose "...wherein the sense line is utilized to thermally assist in switching a magnetic orientation of the at least one of the plurality of magnetic memory elements ..." as recited in claim 1 of the present invention. (Emphasis added.) *Daughton* discloses a ferromagnetic thin-film based digital memory having a bit structures therein a magnetic material film in which a magnetic property thereof is maintained below a critical temperature above which such magnetic property is not maintained, and may also have a plurality of word line structures each with heating sections located across from the magnetic material film in a corresponding one of the bit structures.

These bit structures are sufficiently thermally isolated to allow selected currents in the adjacent word lines or in the bit structure, or both, to selectively heat the bit structure to approach the critical temperature. Such bit structures may have three magnetic material layers each with its own critical temperature for maintaining versus not maintaining a magnetic property thereof.

The Applicant argued in the response filed February 20, 2007 that *Daughton et al.* does not teach "...wherein the sense line includes a first via and a second via ...". In the Examiner's view, "the claims as written also easily read on an arrangement (such as the one found in *Daughton et al.*) where current flows from the sense line to ground through a first via, heating a first SDT associated with said first via, while more current flows from the sense line to ground through a second via, heating a second SDT associated with said second via. The fact that the two vias are indistinguishable from each other in the claims means there is no prohibition on the reference distinguishing them in any way it chooses." Applicant respectfully disagrees with the Examiner's line of reasoning.

Again, independent **Claim 1** has been amended to recite "...wherein the sense line is utilized to thermally assist in switching a magnetic orientation of the at least one of the plurality of magnetic memory elements ...". (emphasis added) The Examiner asserts that no relationship is claimed between either of the vias and the plurality of magnetic memory elements or any single one of said plurality. However, based on the amendment of independent **Claim 1**, a relationship between the first and second via and a single one of the plurality of magnetic memory elements is established. Consequently, based the amended independent **Claim 1**, the Examiner's assertion that there is nothing in the claims to distinguish the first via from the second via is no longer applicable since the first and

Application No. 10/733,089
Responsive to the Office Action of May 9, 2007

page 9

second via of the recited invention is associated with a single one of the plurality of magnetic memory elements.

Therefore, Applicant asserts that a sense line including a first and second via... wherein the sense line is utilized to thermally assist in switching a magnetic orientation of the at least one of the plurality of magnetic memory elements, as recited in independent **Claim 1** is clearly different from the implementation of a single conduction via as disclosed in the *Daughton et al.* reference. Consequently, *Daughton et al.* does not disclose "...a sense line including a first and second via... wherein the sense line is utilized to thermally assist in switching a magnetic orientation of the at least one of the plurality of magnetic memory elements..." as recited in independent **Claim 1** of the present invention. Since the *Daughton et al.* reference does not disclose "...a sense line including a first and second via... wherein the sense line is utilized to thermally assist in switching a magnetic orientation of the at least one of the plurality of magnetic memory elements..." as recited in **Claim 1** of the present invention, the *Daughton et al.* reference does not anticipate independent **Claim 1** of the recited invention. Therefore, independent **Claim 1** is allowable over the *Daughton et al.* reference and the rejection of independent **Claim 1** under 35 U.S.C. §102(e) ought to now be withdrawn.

Claims 2-10 and **13** depend from independent **Claim 1** and inherit all of its limitations. Therefore, **Claims 2-10** and **13** are also patentably distinct in view of the Examiner's reference and the rejections of **Claims 2-10** and **13** under 35 U.S.C. §102(e) ought to now be withdrawn.

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JUN 29 2007

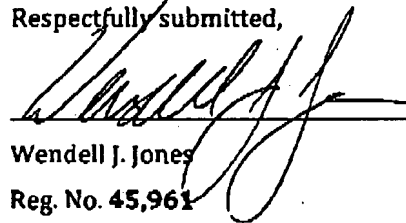
Application No. 10/733,089
Responsive to the Office Action of May 9, 2007

page 10

iii. **CONCLUSION**

Applicant believes that this application is in condition for allowance. Accordingly, Applicant respectfully requests reconsideration, allowance and passage to issue of the claims as now presented. Should any unresolved issues remain, Examiner is invited to call Applicant's attorney at the telephone number indicated below.

Respectfully submitted,



Wendell J. Jones

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